Abstract

Title: Spectral Analysis of Electromyography Data of Power Lifters

Objectives: The aim of this thesis is a description of muscle activity and its measurement using electromyography (EMG), description of parameters of EMG signal and their relationship to neuromuscular physiology. The aim of the practical part is an implementation of spectral analysis of EMG data of power lifters when performing 4 series of 5 split-squats carrying loading in one hand.

Methods: The spectral analysis of EMG data of 35 athletes is presented. The athletes performed 4 series of 5 split-squats with one sided loading. The loading was 25% and 50% of their body mass and the carrying position was homolateral and contralateral to stance leg. Muscles chosen for measurement were vastus medialis obliquus, vastus lateralis obliquus, gluteus medius and biceps femoris of both sides. The implementation of digital signal processing algorithm was done using Matlab and its Signal Processing Toolbox.

The spectral analysis was implemented using discrete Fourier transform with sliding 256-sample window size and 32-sample window increment. The resulting spectrogram was divided into parts based on smoothed EMG. Median frequency for each split-squat was calculated. For the statistical processing we used median frequency differencies (intraindividual comparison) and slopes of regression line (interindividual comparison) for each series of split-squats. We used statistical software SigmaStat for the statistical processing.

Results: The statistical processing of median frequency differencies using method Repeated Measures ANOVA On Ranks revealed intraindividal significant difference for 5 of 8 measured muscles. Intraindividual comparison of two series with different loading detected significant differencies for 4 of 8 muscles for right leg as a stance leg and 2 of 8 muscles for left leg as a stance leg.

Interindividual comparison of athletes according to carried loading and training history showed significant difference only for 1 muscle of 8 measured ones, for vastus lateralis obliquus of the stance leg.

Keywords: EMG, electromyography, biological signal, motor unit, MU, strength training, spectral analysis, Fourier transform, DFT, power spectrum, split-squat, Matlab